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*Oriented Matroids and Neural Codes.*

A combinatorial neural code is a subset of the power set  $2^{[n]}$ . A neural code is convex if it arises as the intersection pattern of convex open sets in  $\mathbb{R}^d$ . In the past few years, there has been considerable progress on characterizing which neural codes are convex, but the problem remains wide open. Here, we show that a code has a realization with convex polytopes if and only if it is the image of a representable oriented matroid under a neural code morphism. We show that most previously known examples of non-convex codes are non-convex because they are not the image of any oriented matroid under a code morphism. Using connections to oriented matroids, we show that recognizing convex neural codes is NP-hard. (Received January 19, 2021)